have been much more illuminating than reproductions of photographs of the outside of the machines. Apart from this defect, which would be corrected by a good lecturer, we have nothing but praise for the book. The chapters on hydraulic cements are particularly good, and there is also a good description of industrial alloys.

LIFE AND ITS INTERPRETATION.

(1) *Les Inconnus de la Biologie déterministe.* By A. de Gramont Lesparre. Pp. 297. (Paris: Felix Alcan, 1914.) Price 5 frs.

(2) *Einführung in die Tierpsychologie auf experimenteller und ethologischer Grundlage.* By Gustav Kafka. Erster Band. Die Sinne der Wirbellosen. Pp. xii + 594. (Leipzig: J. A. Barth, 1914.) Price 18 m.

(3) *L'Espèce et son Serviteur.* (Sexualité, Moralité.) By Prof. A. Cresson. Pp. 347. (Paris: Librairie Felix Alcan, 1913.) Price 6 frs.

(4) *Life and Human Nature.* By Sir Bampfylde Fuller. Pp. xii + 339. (London: John Murray, 1914.) Price 9*s.* net.

(5) *Controlled Natural Selection and Value Marking.* By J. C. Mottram. Pp. ix + 130. (London: Longmans, Green and Co., 1914.) Price 3*s.* 6*d.* net.

(1) A. DE GRAMONT LESPARRE makes a very eloquent protest against determinist biology which has no use for the soul. He indulges in not a little sarcasm at the expense of those who regard the psychical life as an epiphenomenon of cerebral metabolism, and hold that physics and chemistry are sufficient, or will eventually be sufficient, for the description of an animal's daily life. He considers sensation, memory, heredity, reproduction, instinct, intelligence, and so on, and shows that the way of determinist biology is hard. Instead of clearing things up, it lands us in an intellectual fog. He will not have anything to say to "psychoids" and the like, but stands for the old-fashioned soul, an active intellectual principle, simple and autonomous, existing alongside of or rather above physiological phenomena. It is well that the difficulties in the way of mechanistic interpretation should be firmly pointed out, and the author's passionate eloquence need not be taken amiss in these days of compromise; it is well to point out the dangers of question-begging phrases like "the life of crystals," and "the memory of a twisted thread"; it is also well to proclaim the inestimable value of the concept of personality; but we think it far from well that one of the author's standing should give in the closing pages of his book an account of the present state of the theory of organic evolution which we do not hesitate to call a pessimistic and reactionary misrepresentation.

(2) Dr. Gustav Kafka has done an admirable piece of work in bringing together in a synoptic, rather than encyclopædic manner, what is known in regard to the senses of invertebrates. It is the first volume of an introduction to animal psychology, and it raises our expectations for what is to follow. The book is clear and scholarly, and it does not lose sight of the wood in studying the trees. It deals with touch, equilibration, hearing, sensitiveness to temperature, to chemical influences, and to light; and ends with "space-sense" (as in homing) and "time-sense" (as in rhythmic movements), though the author admits that these two titles are scarcely justifiable psychologically. The book has abundant and interesting illustrations, but some of them are a little rough. There is a useful, well-selected bibliography. As to the author's general position, he believes strongly in physiology and psychology minding their respective businesses. The physiologist has to work at the series of spatial happenings between the stimulus and the reaction; the psychologist has to work out a subjective description. Just as a chemist would not be warranted in postulating a magician because he did not follow some of the steps in a long and complicated series of reactions, so the physiologist must not postulate a psychoid factor in his nexus between stimulus and response. But the psychologist need make no apology for working out a different kind of description, equally necessary, and certainly not less real. He must keep close to the observed facts of behaviour, but in his psychological account of these he need not allow himself to be too much hindered by the difference between the nervous organisation of the lower animal and that which he himself possesses. There may be analogous psychical life though the anatomical architecture is quite different. A snake can move very effectively, though it has no limbs.

(3) The aim of Prof. Cresson's admirable book is to emphasise the extent to which organisms are adapted for securing the welfare of their race. In their multiplication, in their reproductive processes, in their parental care, individuals do much that is not to their own advantage; their personal interests have been subordinated to those of the species. They are borne on by impulses and instincts which are as compelling as hunger and thirst, but apart from sexual gratification (which applies only to a relatively small number of cases) the fulfilment of these impulses and instincts is often of little individual advantage. Indeed,

it is often fatal. As Goethe said, Nature holds that for the pains of a lifetime it is fair payment to get a couple of draughts from the cup of love. But many animals have not even this, or the psychic reward of seeing the offspring for the good of which they more or less unwittingly spend themselves.

The author illustrates the physiological cost of producing germ-cells, of nourishing the young before or after birth, of parturition, and so on. Many females die of reproduction, and the drone-bees are far from being the only males that are sacrificed on the altar of sex. Many animals, notably insects, spend a very large proportion of their energy in securing the safety of the eggs and the nourishment of the young. In a charming way the author reminds us, in reference to birds, of the work of nest-making, the patience of brooding, the self-forgetfulness exhibited in feeding, cleaning, guarding, and educating the young. For social insects the formula is suggested: "Everything for the species; everything by the individual; nothing for the individual."

What difficulties often lie in the way of the fertilisation of the egg-cell! How much time, experimenting, vital energy, and elimination has gone to the establishment of the structural adaptations, the impelling desires, and the subtler psychical devices which secure this end. There are parallel adaptations of body, emotion, instinct, and intelligence, which secure the welfare of the young. The author has done very valuable service in bringing into prominence the amount of energy expended towards the maintenance of the species rather than towards self-preservation and self-gratification. Animals have become interested organically, if not consciously, in working for the species; they do not know it, but their personality completes itself in the larger life of their race. They may sometimes work under an illusion, but many are enriched and many are pleased; they do not wholly lose their reward. Metaphors apart, variations (probably altogether germinal to begin with), in directions which made for the welfare of offspring, family, society, or species, have been established in the course of selection no less securely than those which made for self-preservation. Metaphors again, this has been Nature's way of setting the seal of her approval on altruistic behaviour, even when the animal's left hand certainly does not know what its right hand doeth.

(4) Sir Bampfylde Fuller's well-written and wholesome book is divided into three parts—the attributes of life; the constraining influences of race, environment and culture; and man's achievements, material, intellectual, and social. Though the most valuable part of the book is probably the third, which gives expression to the author's experience as an administrator, we must restrict ourselves here to the more strictly biological discussion.

What life in essence is we do not know; we must make the same confession in regard to electricity and gravity; but we cannot suppose that life is the result of matter. We must judge of life by its manifestations. Thus changefulness is one—the flux of everyday metabolism, the cyclical development of the individual, the prodigal variability which evolution implies. Another prerogative is effectively responsive sensitiveness, differing from that of a photographic plate in being associated with a more or less clear "awareness." The other attributes on which the author lays emphasis are instinct and consciousness, spontaneity and repetitiveness. We do not think that he states the attributes very clearly, but no two people agree about this, and it is perhaps more important that he writes in a fresh and interesting way about them from a frankly vitalistic point of view. Living creatures are better defined by their impulses than by their organs. "We do not see because we have eyes, but we have eyes because we have an impulse to see." Life is not a series of activities produced by a particular type of substance or machinery, but may be better thought of as a complicated energy of (it may be figured) "interlacing whirls which animates the mechanism of the body, and is not caused by it." The author shows no wavering in his conviction that life transcends mechanism.

(5) Dr. Mottram thinks that he has got hold of a new theory, supplementary to Darwinism. He illustrates it with enthusiasm and with a pleasant frankness, most of his test cases being taken from birds. The theory is that of *controlled* Natural Selection, which seems to mean this:—The variations presented to the sieve of Natural Selection are not all of the same value for the welfare of the species; thus variations in males are not so important as variations in females, for males are less valuable than females; and one set of variations is more liable to be selected than another, challenging criticism more, as it were. Thus what Natural Selection effects is in a sense "controlled" by the nature or value of the variations that are forthcoming. What truth is there in this? If we compare the action of Natural Selection to that of a pruning knife, and liken variations to the new growths of a tree, we may say that the final result is a function of the growth on the one hand and the pruning on the other. But the phrase "controlled selection" is surely misleading. Then again, as

to value, some new departures are certainly of more value than others, but the value is relative, not absolute; it is in relation to the particular exigencies of the species. We agree with the author that a variation may be established, though it is not of individual value; thus, as Darwin clearly stated, a variation in the direction of greater parental care may become a race-saving specific character, but its value is always in relation to particular conditions of life, *i.e.* in relation to the selection that goes on. To say that Natural Selection is thus controlled is arguing in a circle.

Dr. Mottram has an excellent chapter on the values of conspicuousness, whether of movement, form, sound, scent or colour; and he has the courage to uphold the thesis—the converse of Wallace's—that "the male becomes brilliant in colour in order that he may be more likely to be destroyed: and thus the dull-coloured female gain protection"! This would naturally lead to the elimination of the more brilliant males, but fortunately they mate before they are killed, so that their brilliant qualities are handed on! It would be equally easy to suggest that the character which is established is not merely conspicuousness, but conspicuousness plus such agility that the gay fellows are never caught. We think that the author should re-consider his theory. As a lover of birds, by the way, he should not have passed such a large number of disfiguring misprints in their proper names—we counted ten without looking for them.

OUR BOOKSHELF.

Clean Water and How to Get It. By Allen Hazen. Second edition, revised and enlarged. Pp. xii + 196 + plates. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1914.) Price 6*s.* 6*d.* net.

We are glad to see a second edition of Mr. Allen Hazen's useful little book on water purification. There are still the interesting chapters describing the various sources of supply and methods of purification, and considerable space is devoted to the problems arising from the tastes and odours developing in water through stagnation and the growth of organisms. Other chapters relate to statistics of supply in different cities, and suggestions are made as to the relative sizes of the several parts of a water works which would be useful in designing a new supply.

New chapters have been added dealing with the "red water" problem, and with the disinfection of water supplies, and it is unfortunate that, with regard to the latter question the author has not gone into the subject more fully, as it is a question which has recently received a great deal of study, both in this country and more particularly in the United States.

Two omissions immediately occur to the English reader, the first being that the author fails to recognise the pioneer work done in this country by Dr. Houston and others on the use of hypochlorites as sterilising agents, and does not mention at all that the first time these substances were used on any considerable scale was at Lincoln in 1905, when in consequence of a serious epidemic of typhoid fever the whole of the water supply was continuously sterilised with sodium hypochlorite by Dr. Houston for more than a year with remarkable success.

The other point is that no mention whatever is made of the now well-known "excess lime" method of sterilisation of Dr. Houston, which was first described by him in 1912 in his reports to the Metropolitan Water Board, and has since been successfully applied to several water supplies both in this country and in the United States.

The book is well illustrated with photographs, and is worth a place on the bookshelf of everyone engaged in the scientific study of water supply. D. B. B.

The Vaccination Question in the Light of Modern Experience: An Appeal for Reconsideration. By Dr. C. K. Millard. Pp. xviii + 243. (London: H. K. Lewis, 1914.) Price 6*s.* net.

Dr. Millard's book is carefully and well written, and with authority; and the general plan of it is very good. He believes, absolutely and profoundly, in the power of vaccination to safeguard each of us against smallpox; and he is outspoken, as he ought to be, over the folly of all who deny this fact. But he feels, very strongly, that the "Leicester experiment"—the rigorous constant notification, isolation, surveillance of contacts, sanitation, emergency vaccination, and so forth—has been a success, not a failure. He points out, very truly, that the danger is less from severe cases than from slight, "masked," unrecognised cases; and these cases often occur in persons lightly and inadequately vaccinated to satisfy the law. He tells the dreadful story of Dewsbury and of Gloucester, where the people had Leicester's anti-vaccination spirit without Leicester's sanitation. The main purpose of his book is to underline the difference between vaccination as a personal safeguard and vaccination as a civic safeguard.

The whole book is of singular interest. It is open to criticism here and there. The author does not lay enough stress on the fact that evil or fatal effects from non-aseptic vaccination belong, nearly all of them, to a time which is happily over and done with. He does not sufficiently reckon with the chance of contact cases escaping from surveillance and flitting outside the cordon. It may be, also, that he ought to make more allowance for the possible surprise of the disease flaring up with unexpected virulence of type: we must be very careful how we talk of a disease "dying